Distribution, habitat and conservation status of *Paradelma orientalis* Günther 1876 (Lacertilia: Pygopodidae)

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Introduction

Paradelma orientalis is a member of the monophyletic and endemic family of Australian lizards, the Pygopodidae (Kluge 1974). Until relatively recently *P. orientalis* was known only from a small number of scattered localities exclusively within the central and southern Brigalow Belt region, east of the Great Dividing Range in south-central Queensland (Wilson and Knowles 1988; Cogger *et al.* 1993). New populations are now known for the southern, eastern and western extremes of this bioregion (Schulz and Eyre 1997; Tremul 1999).

The eponymous common name implies *P. orientalis* has a strong association with the Brigalow Belt and this is certainly its core distribution (Covacevich *et al.* 1998). Habitat is generically reported as woodland consisting of, or associated with, Brigalow *Acacia harpophylla* vegetation (Wilson and Knowles 1988; Cogger *et al.* 1993; Sattler and Williams 1999), though a range of other *Eucalyptus* woodland associations without Brigalow have been recorded (Shea 1987; Wilson and Knowles 1988; Schulz and Eyre 1997; Tremul 1999). Many of these have a dense sub-canopy of other rough-barked species such as *Callitris columellaris*, *Allocasuarina luehmanni* and *Acacia falciformis* (Schulz and Eyre 1997; Tremul 1999). The biology of the species is poorly known. It is known to be oviparous, laying two eggs (Greer 1989), and detailed observations of a population on Boyne Island indicate it clearly nocturnal, active in temperatures generally above 19°C, partly arboreal, and both a sap and invertebrate feeding species (Tremul 1999). Sap feeding is unreported for other Pygopodids (Tremul 1999), but has been observed for geckos (Couper *et al.* 1995).

The Brigalow Belt is one of the most highly modified and poorly reserved bioregions in Queensland (Covacevich *et al.* 1998; Sattler and Williams 1999) and almost no baseline or detailed bioregional fauna survey was conducted in the Brigalow Belt prior to the onset of extensive land clearance schemes in the 1960's (Gordon 1984; Covacevich *et al.* 1998). Twenty-seven reptiles are considered restricted to, or significantly distributed within, this bioregion, eighteen being of conservation significance (Covacevich *et al.* 1998). *Paradelma orientalis* is listed as vulnerable in Queensland under the Nature Conservation Legislation Amendment Regulation (No. 2) 1997 and Action Plan for Australian Reptiles (Cogger *et al.* 1993), though its continued appearance in new locations caused some authors to consider its conservation status requiring further investigation (Schulz and Eyre 1997). Habitat modification and conversion of native woodland to pasture and agriculture is considered to have had a severe impact on the pre-European distribution and abundance of this species (Gordon 1984; Cogger *et al.* 1993; Covacevich *et al.* 1998). This note reports new locality data for *P. orientalis* collected incidentally during large-scale vertebrate fauna surveys in the Desert Uplands and Northern Brigalow Belt. Habitat data and implications for conservation status are discussed.

Study aims and methods

Distribution data for *P. orientalis* were collected from two studies conducted in the savanna woodlands of central and northern Queensland between 1997 and 2000. The first (by ASK) assessed variation of vertebrate species abundance and distribution in a range of regional ecosystem types (*sensu* Sattler and Williams 1999) within the Desert Uplands Bioregion (DEU). The second (by NYT and DSH) surveyed the impacts of tree clearing and habitat fragmentation on poplar box *Eucalyptus populnea* and silver-leaved ironbark *E. melanophloia* woodlands within the Northern Brigalow Belt and southern Desert Uplands bioregions (NBB/SDEU) (Fig. 1).

Sampling in both surveys utilised a standardised nested quadrat array (1ha), modified from Woinarski and Fisher (1995), incorporating four pitfall and twenty small Elliott traps, operated over a 96 hours period. Trapping was supplemented by daily timed diurnal and nocturnal searches in the quadrats. The DEU survey sampled 158 quadrat sites (105 of these being sampled twice), where as the NBB/SDEU survey sampled 104 quadrats, each of these twice. Both surveys can be considered moderately intensive.

The Desert Uplands and Brigalow Belt Bioregions are situated within Australia's northern tropical savannas. The former straddles the Great Dividing Range shares a boundary to the east with the latter. The Desert Uplands is semi-arid, dominated by sandstone ranges and sand plains with soils of mostly poor structure and fertility comprising open *Acacia* and *Eucalypt* woodlands, ephemeral lake and dune systems and hummock and tussock grasslands (Sattler and Williams 1999). The Brigalow Belt is one of the largest and most complex bioregions in Queensland, extending from Townsville to the New South Wales border. The bioregion is characterised by the leguminous tree Brigalow *Acacia harpophylla*, although the majority of vegetation is a complex mix of other *Acacia* and *Eucalypt* woodlands, dry rainforest, riparian and cypress pine woodlands, predominantly on fertile soils (Sattler and Williams 1999).

New records of Paradelma orientalis

A new northern distribution limit (Fig. 1) and habitat data were recorded for *P. orientalis* from these fauna surveys. Two *P. orientalis* were located during active searching on Ulcanbah Station, 200km south west of Charters Towers, one on 30/3/2000 (22° 1' 32.7"S, 145° 56' 19.3"E) during nocturnal active searching and the other on 2/4/2000 (22° 0' 56.8"S, 145° 55' 30.2"E) under a log during a diurnal search. One specimen was collected as a voucher for verification, and deposited at the Queensland Museum (QMJ73646). The vegetation of both sites was low Gidgee *Acacia cambagei* woodland with occasional *Eremophila mitchelli* and *Carissa ovata*, and a sparse to moderate ground cover of forbs (*Sclerolaena* spp., *Sida* spp.) and grasses (*Paspalidium* spp., *Eragrostris* spp. and *Eriochloa crebra*). The soils of the site were moderately cracking alluvial clays and there was abundant fallen timber.

Three *Paradelma orientalis* were recorded from Bacchus Downs Station, 50 km south from Nebo. Two were found while searching fallen litter in a 75 ha patch of poplar box woodland on 9/12/1998 (22° 14' 17.9"S, 148° 51' 47.8"E) and the third by virtue of a sloughed skin while searching in a 10 ha patch of poplar box woodland on 9/12/1998 (22° 13' 54.8S", 148° 51' 55.1E"). The identification of the sloughed skin was confirmed by the Queensland Museum (P. Couper, pers. comm., Queensland Museum 2000), though neither of the live specimens were collected, as the authors were familiar with the identity of this distinctive pygopodid. Both patches were isolated from other woodland by introduced Buffel grass *Cenchrus ciliaris* pasture, and grazing pressure was moderate to heavy within both sites. The vegetation was characterised by open woodland of *Eucalyptus populnea* sometimes with *Eremophloia mitchelli* in the mid-storey, and a ground layer of tussock grasses. The terrain was flat to undulating with sandy-clay alluvial soils.

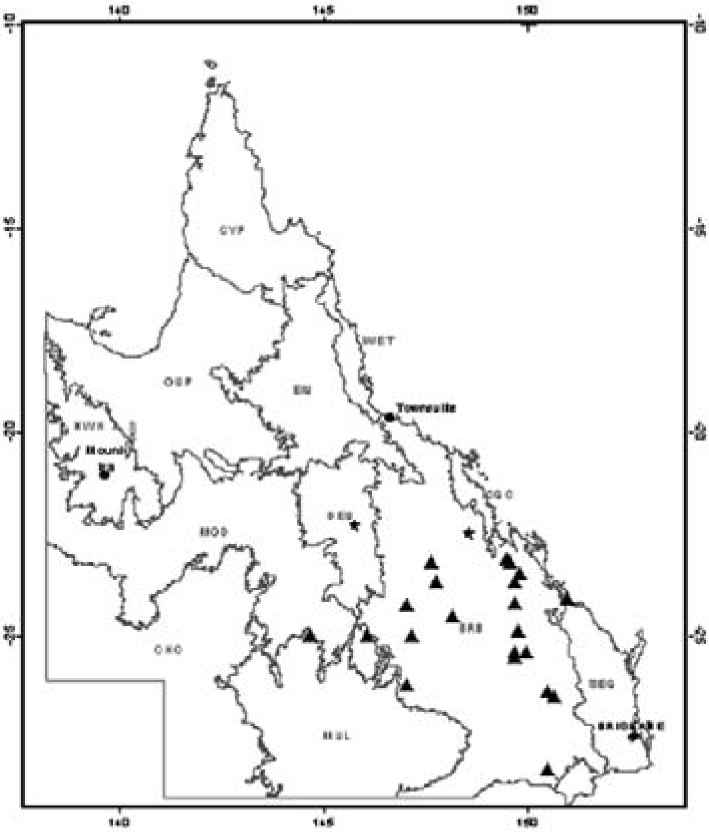

Figure 1. The distribution of *Paradelma orientalis* showing new localities for (bold stars) and previous localities from the Queensland Museum records (bold triangles). Bioregion abbreviations: MGD = Mitchell Grass Downs, DEU = Desert Uplands, BRB = Brigalow Belt, CHC = Channel Country, MUL = Mulga Lands, CQC = Central Queensland Coast, SEQ = South-east Queensland.

Discussion

For any species, especially those of conservation concern, the discovery of new populations outside previously considered distributional limits is encouraging. Conversely it also emphasises many areas of northern Queensland have been inadequately surveyed for vertebrate fauna, a fact often highlighted but rarely addressed (Gordon 1984; see review of bioregional fauna data in Sattler and Williams 1999). The location of *P. orientalis* within the Desert Uplands extends the known distribution to the north-west. The records also lie on the eastern edge of the Great Dividing Range, within a catchment that flows into the Belyando and then the Burdekin River, a system that has a strong climatic and vegetation affiliation with the Northern Brigalow Belt (Sattler and Williams 1999). However, sandstone escarpments, poplar box woodlands and other *Acacia* woodlands are common in the central and eastern sub-regions of the Desert Uplands Bioregion, and this species may be distributed throughout this area.

The records from near Nebo increase the extent of *P. orientalis* distribution northwards. Habitat similar to that reported here and previously (see Introduction), extends towards Charters Towers and Townsville, though any climatic constraints on the distribution of this species are unknown. The presence of these records in fragmented woodland sites surrounded by cleared pasture also implies the persistence of a threatened species in a modified landscape, though this naturally provides no information on population trend or viability. However the NBB/SDEU survey that recorded these specimens sampled over 100 sites twice, in a range of vegetation remnants (5-2000 ha), and only three *P. orientalis* were recorded. Whether these represent a naturally rare species, sparse records at the edge of its range, or perhaps one impacted and declining, is uncertain with so few records. In other locations in intact habitat, *P. orientalis* is reported as abundant (Tremul 1999).

However, Cogger *et al.* (1993) identified habitat clearing, logging and overgrazing by cattle as threatening processes, and there is no reason to dispute this on evidence of low captures in the current surveys. Species richness and abundance of reptiles and birds declined in smaller woodland remnants and cleared pasture in the NBB/SDEU study (Ludwig *et al.* 2000; Hannah and Thurgate 2001). Clear evidence is emerging that low targets for remnant vegetation protection leads to dramatic species loss and continuing extinction over time (Barrett 2000; James and Saunders 2001). Setting of inadequate protection benchmarks (e.g. 10-30% of original vegetation, JANIS 1997) is probably one of the more serious threats to conservation of biodiversity in the present era. Vertebrate fauna decline and extinction in the Brigalow Belt (e.g. *Psephotus pulcherrimus*, *Notomys mordax*, *Onychogalea fraenata*, *Lasiorhinus krefftii*, *Lerista allenae* and 74 others) associated with unfettered clearing and lack of native vegetation reservation is testament to this notion (Gordon 1984; Covacevich *et al.* 1998; Sattler and Williams 1999).

Though *P. orientalis* is seemingly more widespread than early literature suggests, downgrading the significant conservation status would be premature without further investigation, a point already highlighted by Schulz and Eyre (1997). Though reporting rate for the species has increased, it is still poorly collected across its range, and regardless this is an inadequate surrogate for judging variation in status without more uniform sampling effort across its range. Furthermore the surveys of the DEU and NBB/SDEU, representing over 7500 pitfall trap nights and 350 hours of active searching, resulted only in the five *P. orientalis* reported here. This suggests a species still uncommon and rare.

There seems to be a clear affinity between *P. orientalis* and the presence of a canopy or mid-storey of *Acacia* or similar rough-barked trees. *Paradelma orientalis* specimens are known to be sap-feeders (Cogger *et al.* 1993; Tremul 1999), suggesting an association with *Acacia* vegetation. These communities were targeted extensively for clearing in the Brigalow Belt (Sattler and Williams 1999), and purely by reference to the loss of pre-European extent of this vegetation, one could speculate that *P. orientalis* may have once been exceptionally common. The unfortunate footnote to this is that we will now never definitively know.

Acknowledgements

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References

Barrett, G. 2000. *Birds on Farms. Ecological Management for Agricultural Sustainability*. Supplement to Wingspan 10. Birds Australia, East Hawthorn, Victoria.

Cogger, H.G., Cameron, E.E., Sadlier, R.A. and Eggler, P. 1993. *The Action Plan for Australian Reptiles*. Australian Nature Conservation Agency, Canberra.

Covacevich, J.A., Couper, P.J. and McDonald, K.R. 1998. Reptile diversity at risk in the Brigalow Belt, Queensland. *Memoirs of the Queensland Museum* **42:** 475-486.

Couper, P.J., Covacevich, J.A. and Wilson, S.K. 1995. Sap feeding by the Australian gecko *Gehyra dubia*. *Memoirs of the Queensland Museum* **38:** 396.

Gordon, G. 1984. Fauna of the Brigalow Belt. Pp. 61-70 in *The Brigalow Belt of Australia*, edited by A. Bailey. Royal Society of Queensland, Brisbane.

Greer, A.E. 1989. *The Biology and Evolution of Australian Lizards*. Surrey, Beatty and Sons, Chipping Norton, NSW.

Hannah, D. and Thurgate, N. 2001. Lands of strips and patches. *Wildlife Australia*. **Autumn 2001**, 38-41.

James C. and Saunders, D. 2001. *A Framework for Terrestrial Biodiversity Targets in the Murray-Darling Basin.* CSIRO and Murray-Darling Basin Commission, Canberra.

JANIS 1997. *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*. ANZECC, Canberra.

Kluge, A.G. 1974. *A Taxonomic Revision of the Lizard Family Pygopodidae*. Miscellaneous publications of the Museum of Zoology, University of Michigan, No. 147. University of Michigan, Ann Arbor.

Ludwig, J.A., Eager, R.W., Liedloff, A.C., McCosker, J.C., Hannah, D.S., Thurgate, N.Y., Woinarski, J.C.Z. and Catteral, C.P. 2000. Clearing and grazing impacts on vegetation patch structures and fauna counts in eucalypt woodland, Central Queensland. *Pacific Conservation Biology* **6**: 254-272.

Sattler, P.S. and Williams, R.D. (eds.) 1999. *The Conservation Status of Queensland's Bioregional Ecosystems.* Environment Protection Agency, Brisbane.

Schulz, M. and Eyre, T.J. 1997. New distribution and habitat data for the Pygopodid *Paradelma orientalis* Gunther 1876. *Memoirs of the Queensland Museum* **42:** 212.

Shea, G.M. 1987. Notes on the biology of *Paradelma orientalis*. *Herpetofauna* **17:** 5-6.

Tremul, P.R. 1999. Breeding, feeding and arboreality in *Paradelma orientalis*: a poorly known, vulnerable pygopodid from Queensland, Australia. *Memoirs of the Queensland Museum* **45:** 599-609.

Wilson, S.K. and Knowles, D.G. 1988. *Australia's Reptiles: a Photographic Reference to the Terrestrial Reptiles of Australia*. Collins, Sydney.

Woinarski, J.C.Z. and Fisher, A. 1995. Wildlife of lancewood (*Acacia shirleyi*) thickets and woodlands in Northern Australia. 1. Variation in vertebrate species composition across the environmental range occupied by lancewood vegetation in Northern Territory. *Wildlife Research* **22**: 379-412.